

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

1. (Currently amended) A method for dynamically establishing an ad-hoc network including a plurality of work machines, one or more of which may move within an environment and each of which includes a gateway, the method performed by a respective gateway included within a respective one of the work machines and comprising:

identifying a first sub-network of the plurality of work machines that are within direct communication range of the respective work machine and each other based on the respective work machine's current location within the environment;

storing, by the respective work machine, information identifying and associating each of the work machines in the first sub-network;

identifying a second sub-network of the plurality of work machines that are in direct communication range of one or more of the work machines in the first sub network and each other, the second sub-network including at least one work machine not included in the first sub-network;

storing, by the respective work machine, information identifying and associating each of the work machines in the second sub-network;

forwarding a packet received from a first work machine included in the first sub-network to a second work machine included in the first sub-network based on a determination that the second work machine is either directly or indirectly within communication range of a third work machine included in the second sub-network, the

packet containing information relating to an operational parameter of a mechanical system on-board one of the plurality of work machines; and

updating the stored information identifying and associating the work machines included in the first and second sub-networks of the plurality of work machines based on at least one of:

(i) the respective work machine changing locations within the environment, and

(ii) any of the work machines included in the first or second sub-networks changing locations within the environment.

2. (Currently amended) The method of claim 1, wherein the packet is destined for a destination work machine not included in the first or second sub-networks of the plurality of work machines, and forwarding the packet includes:

forwarding the packet to the second work machine based on a determination that the third work machine is in direct communication range of the destination work machine.

3. (Currently amended) The method of claim 1, wherein the packet is destined for a destination work machine not included in the first or second sub-networks of the plurality of work machines, and forwarding the packet includes:

forwarding the packet to the second work machine based on a determination that the third work machine can indirectly communicate with the destination work machine.

4. (Currently amended) The method of claim 1, wherein identifying the first sub-network of the plurality of work machines includes:

broadcasting an admission packet;

receiving a response from at least one of the first and second work machines; and

adding at least one of the first and second work machines to the first sub-network of the plurality of work machines based on the received response.

5. (Currently amended) The method of claim 4, wherein identifying the second sub-network of the plurality of work machines includes:

collecting, from the response, an identifier associated with the third work machine; and

adding the third work machine to the second sub-network of the plurality of work machines, wherein the identifier reflects that at least one of the first and second work machines are either directly or indirectly in communication with the third work machine.

6. (Currently amended) The method of claim 1, wherein updating the stored information identifying and associating the work machines included in the at least one of the first and second sub-networks of the plurality of work machines further includes:

determining that the respective work machine has moved to a first location; and

repeating the determining of the first sub-network of the plurality of work machines when the first location is beyond a certain distance from the current location.

7. (Currently amended) The method of claim 1, wherein updating the stored information identifying and associating the work machines included in the first and second sub-networks of the plurality of work machines further includes:

periodically repeating the step of determining the first sub-network of the plurality of work machines.

8. (Currently amended) The method of claim 1, wherein updating the stored information identifying and associating the work machines included the first and second sub-networks of the plurality of work machines further includes:

removing from the first sub-network any work machines that are not in direct communication with the respective work machine.

9. (Currently amended) The method of claim 8, wherein updating the stored information identifying and associating the work machines included in the first and second sub-networks of the plurality of work machines further includes:

removing from the second sub-networks any work machines that are not in direct communications with any work machines included in the first.

10. (Currently amended) The method of claim 1, wherein the respective work machine is connected to at least two data links capable of transmitting the packet from the respective work machine and forwarding the packet further includes:

selecting one of the at least two data links to forward the packet to the first work machine based on at least one of an availability status of each of the data links, a cost of communicating over each data link, a quality of service associated with each

data link, a priority of the packet, and a transmission time associated with each data link.

11. (Currently amended) The method of claim 1, wherein the packet is destined for a destination work machine and the respective gateway includes a first network table, the first network table containing the information identifying and associating each of the work machines in the first sub-network and information identifying work machines in the second sub-network that are within direct communication range of work machines in the first sub-network, and forwarding the packet includes:

forwarding the packet to the second work machine based on a determination that the second work machine is associated with the destination work machine in the first network table.

12. (Currently amended) The method of claim 1, wherein the packet is destined for a destination work machine and the respective gateway includes a first and a second network table, wherein:

the first network table contains the information identifying and associating each of the work machines in the first sub-network and information identifying work machines in the second sub-network that are in direct communication range of work machines in the first sub-network;

the second network table contains the information identifying and associating each of the work machines in the second sub-network and information

identifying work machines in neither of the first and second sub-networks that are in direct communication range of work machines in the second sub-network; and

forwarding the packet includes forwarding the packet to the second work machine based on a determination that the destination work machine is associated with the third work machine in the second network table and the third work machine is associated with the second work machine in the first network table.

13. (Currently amended) A system for dynamically establishing communications between a plurality of work machines, one or more of which may move within an environment, the system comprising:

a first work machine positioned in a first location within the environment;
a first gateway included in the first work machine that connects an on-board data link with an off-board data link; and

a network table included in the first gateway that identifies work machines that are either directly or indirectly within communication range of the first work machine, wherein the network table contains:

information identifying and associating a first sub-network of the plurality of work machines that are within direct communication range of the first work machine and each other, and

information identifying a second sub-network of the plurality of work machines that are within direct communication range of at least one of the work machines in the first sub-network and each other, the second sub-network including at least one work machine not included in the first sub-network,

wherein the first gateway is configured to:

update the network table based on at least one of (i) the first work machine changing locations within the environment and (ii) any of the work machines included in the first or second sub-networks changing locations within the environment,

receive a packet over the off-board data link from a second work machine included in the first sub-network, wherein the packet identifies identifying a destination work machine and containing information relating to an operational parameter of a mechanical system onboard one of the plurality of work machines,

forward the received packet to a third work machine included in the first sub-network based on a determination that the destination work machine is associated with the third work machine in the network table, and

send information included in the received packet to the on-board data link when the packet identifies the first work machine as the destination work machine.

14. (Currently amended) The system of claim 13, wherein the first gateway is configured to update the work machines included in the at least one of the first and second sub-networks identified in the network table based on at least one of (i) the first work machine moving out of communication range of any work machine in the first sub-network, (ii) any one of the work machines included in the first sub-network moving out of communication range of the first work machine, (iii) any one of the work machines in the first sub-network moving out of communication range of any one of the work machines in the second sub-network, and (iv) any of the work machines in the second

sub-network moving out of communication range of any one of the work machines in the first sub-network.

15. (Currently amended) The system of claim 13, wherein the network table includes a first level table identifying the first and second sub-networks and a second level table identifying a third sub-network of the plurality of work machines that are within communication range of any of the work machines in the second sub-network, and the first gateway is further configured to:

forward the packet to the third work machine based on a determination that the destination work machine is associated with a fourth work machine included in the third sub-network and the third work machine is associated with the fourth work machine in the second level table.

16. (Currently amended) The system of claim 13, wherein the first gateway is further configured to:

broadcast an admission packet;
receive a response from at least one of the second and third work machines; and

add at least one of the second and third work machines to the first sub-network of the plurality of work machines based on the received response.

17. (Currently amended) The system of claim 13, wherein the first gateway is further configured to:

periodically broadcast an admission packet to determine whether the first work machine is within communication range of any of the work machines in the environment.

18. (Currently amended) The system of claim 17, wherein the first gateway is further configured to:

remove a work machine from the first sub-network when the first work machine can no longer directly communicate with that work machine.

19. (Currently amended) The system of claim 17, wherein the first gateway is further configured to:

remove a work machine from the second sub-network when the work machine can no longer directly or indirectly communicate with the destination work machine.

20. (Currently amended) The system of claim 13, wherein the first work machine is connected to at least two data links capable of transmitting the packet from the first work machine and the first gateway is further configured to:

select one of the at least two data links to forward the packet to the third work machine based on at least one of an availability status of each of the data links, a cost of communicating over each data link, a quality of service associated with each data link, a priority of the packet, and a transmission time associated with each data link.

21. (Currently amended) The system of claim 13, wherein the first gateway is further configured to:

translate the information included in the received packet to a format compatible with the on-board data link when the packet identifies the first work machine as the destination work machine.

22. (Currently amended) The system of claim 13, wherein the third work machine includes a respective gateway that is configured to check a respective network table to identify a fourth work machine that is either directly or indirectly in communication with the destination work machine and forward the packet received from the first work machine to the fourth work machine.

23. (Currently amended) The system of claim 13, wherein the first gateway is configured to:

trace the network table to determine the association between the third work machine and the destination work machine.

24. (Currently amended) The system of claim 23, wherein the association between the third work machine and destination work machine includes an intermediate work machine that is in direct communication with the third and destination work machines.

25. (Canceled)

26. (Currently amended) A computer-readable storage device including instructions for performing, when executed by a processor, a method for dynamically establishing an ad-hoc network including a plurality of work machines, one or more of which move within an environment and each of which includes a gateway, the method

performed by a respective gateway included within a respective one of the work machines and comprising:

identifying a first sub-network of the plurality of work machines that are within direct communication range of the respective work machine and each other based on the respective work machine's current location within the environment;

storing, by the respective work machine, information identifying and associating each of the work machines in the first sub-network;

identifying a second sub-network of the plurality of work machines that are in direct communication range of one or more of the work machines in the first sub-network and each other, the second sub-network including at least one work machine not included in the first sub-network;

storing, by the respective work machine, information identifying and associating each of the work machines in the second sub-network;

forwarding a packet received from a first work machine included in the first sub-network to a second work machine included in the first sub-network based on a determination that the second work machine is either directly or indirectly within communication range of a third work machine included in the second sub-network, the packet containing information relating to an operational parameter of a mechanical system on-board one of the plurality of work machines; and

updating the stored information identifying and associating the work machines included in the first and second sub-networks of the plurality of work machines based on at least one of:

(i) the respective work machine changing locations within the environment, and

(ii) any of the work machines included in the first or second sub-networks changing locations within the environment.

27. (Currently amended) The computer-readable storage device of claim 26, wherein the packet is destined for a destination work machine not included in the first or second sub-networks of the plurality of work machines, and forwarding the packet includes:

forwarding the packet to the second work machine based on a determination that the third work machine is in direct communication range of the destination work machine.

28. (Currently amended) The computer-readable storage device of claim 26, wherein the packet is destined for a destination work machine not included in the first or second sub-networks of the plurality of work machines, and forwarding the packet includes:

forwarding the packet to the second work machine based on a determination that the third work machine can indirectly communicate with the destination work machine.

29. (Currently amended) The computer-readable storage device of claim 26, wherein determining the first sub-network of the plurality of work machines includes:

broadcasting an admission packet;

receiving a response from at least one of the first and second work machines; and

adding at least one of the first and second work machines to the first sub-network of the plurality of work machines based on the received response.

30. (Currently amended) The computer-readable storage device of claim 29, wherein determining the second sub-network of the plurality of work machines includes:

collecting, from the response, an identifier associated with the third work machine; and

adding the third work machine to the second sub-network of the plurality of work machines, wherein the identifier reflects that at least one of the first and second work machines are either directly or indirectly in communication with the third work machine.

31. (Currently amended) The computer-readable storage device of claim 26, wherein updating the stored information identifying and associating work machines included in the first and second sub-networks of the plurality of work machines further includes:

determining that the respective work machine has moved to a first location; and

repeating the determining of the first sub-network of the plurality of work machines when the first location is beyond a certain distance from the respective work machine's current location.

32. (Currently amended) The computer-readable storage device of claim 26, wherein updating the stored information identifying and associating work machines included in the first and second sub-networks of the plurality of work machines further includes:

periodically repeating the step of determining the first sub-network of the plurality of work machines.

33. (Currently amended) The computer-readable storage device of claim 26, wherein updating the work machines included in the at least one of the first and second sub-networks of the plurality of work machines further includes:

removing from the first sub-networks any work machines that are not in direct communication with the respective work machine.

34. (Currently amended) The computer-readable storage device of claim 33, wherein updating the stored information identifying and associating work machines included in the first and second sub-networks of the plurality of work machines further includes:

removing from the second sub-network any work machines that are not in direct communications with any work machines included in the first sub-network.

35. (Currently amended) The computer-readable storage device of claim 26, wherein the respective work machine is connected to at least two data links capable of transmitting the packet from the respective work machine and forwarding the packet further includes:

selecting one of the at least two data links to forward the packet to the first work machine based on at least one of an availability status of each of the data links, a cost of communicating over each data link, a quality of service associated with each data link, a priority of the packet, and a transmission time associated with each data link.

36. (Currently amended) The computer-readable storage device of claim 26, wherein the packet is destined for a destination work machine and the respective gateway includes a first network table, the first network table containing the information identifying and associating each of the work machines in the first sub-network and information identifying work machines in the second sub-network that are within direct communication range of work machines in the first sub-network, and forwarding the packet includes:

forwarding the packet to the second work machine based on a determination that the second work machine is associated with the destination work machine in the first network table.

37. (Currently amended) The computer-readable storage device of claim 26, wherein the packet is destined for a destination work machine and the respective gateway includes a first and second network table, wherein:

the first network table contains the information identifying and associating each of the work machines in the first sub-network and information identifying work machines in the second sub-network that are in direct communication range of work machines in the first sub-network; and

the second network table contains the information identifying and associating each of the work machines in the second sub-network and information identifying work machines in neither of the first and second sub-network that are in direct communication range of work machines in the second sub-network; and

wherein forwarding the packet includes[[::]] forwarding the packet to the second work machine based on a determination that the destination work machine is associated with the third work machine in the second network table and the third work machine is associated with the second work machine in the first network table.

38. (Currently amended) A method for dynamically establishing an ad-hoc network including a plurality of work machines, one or more of which may move within an environment and each of which includes a gateway, the method performed by a respective gateway included within a respective one of the work machines and comprising:

identifying a first sub-network of the plurality of work machines that are within direct communication range of the respective work machine and each other based on the respective work machine's current location within the environment;

storing, by the respective work machine, information identifying and associating each of the work machines in the first sub-network;

identifying a second sub-network of the plurality of work machines that are in direct communication range of one or more of the work machines in the first sub-network and each other, the second sub-network including at least one work machine not included in the first sub-network; and

forwarding a packet to a computer-readable storage device of a second work machine included in the first sub-network based on a determination that the second work machine is either directly or indirectly within communication range of a third work machine included in the second sub-network, wherein the packet is either (i) received from a first work machine included in the first sub-network or (ii) generated within the respective work machine, the packet containing information relating to an operational parameter of a mechanical system on-board one of the plurality of work machines:

wherein determining the first sub-network, determining the second sub-network, and forwarding are performed when the respective work machine is prepared to forward the packet to another work machine.